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UNDERSTANDING OUR COGNITIVE PROCESSES

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ABSTRACT

The constant question about the cognitive abilities of animals and their possible linguistic potential has been constant interrogation in our society for decades. The present paper aims to give an account of the cognitive processes that both children and animals develop throughout the process of language acquisition, linguistic communication, and language learning. Thus, the characteristics of receiving, processing, storing and using information that both infants and animals share are provided. It is important to note here though that these four processes are framed in the context of animals trying to learn to communicate, through different means, understanding and using similar structures to human speech; hence, this paper does not consider natural communication systems of animals in the wild, but novel communication systems mainly taught in laboratory settings.

KEYWORDS: cognition, language, communication, information processing, memory.

INTRODUCTION

Whenever we see our dogs performing their "guilty" faces or we watch a funny attitude in our neighbour's cat, we cannot help asking ourselves how it is that they do it to communicate their feelings and emotions so humanly-like. Are animals really able to perceive and understand the world as we, humans, do? How they do it? And to what extent are there similarities and differences between us in terms of cognitive processes?

The similarities between us, humans, and chimpanzees go beyond the funny expressions they seem to imitate, for example, when we watch a YouTube video in which there is a chimp using a lipstick in front of the mirror and we think how cute that is and how it is possible that they can emulate our actions. The truth is that we share a lot more than many people think. Rather than being a practical investigation on the matter, this paper aims at providing a theoretical and bibliographic basis. This, as it is of crucial importance for many academics, teachers, and students involved in the field of education and social sciences to understand the way in which children start acquiring language and learning about the world that surrounds them, making it possible to compare those processes to the ones developed by animals.

SOME CRUCIAL CONCEPTS

In general terms, cognition in used in psychology to refer to the mental act or process by which knowledge is acquired, including perception, intuition, and reasoning (Collins English Dictionary).

According to Usha Goswami (2008: 373) "the most comprehensive theory of cognitive development has been Piaget's theory of logical development". Jean Piaget focused mainly on the cognitive development of children, and his theory described and explained the changes that occur in logical thinking at this period. Piaget suggested that cognitive development occurs following a series of 4 stages of maturation and experience: sensory-motor, preoperational, concrete operations and formal operations. In general terms, Piaget postulated that "knowledge is constructed by the child as a consequence of his or her active experiences with the external world" (Ibid).

However, Piaget was not the only psychology who came up with a cognitive theory. Lev Vygotsky's Theory of Sociocultural Development states that individuals learn through social interactions and their culture. Vygotsky explained that dialogue is an important psychological tool in the development of the child's thinking, and as children grow and develop; their basic language becomes more complex. According to his ideas, "knowledge originated in socially meaningful activity and was shaped by language" (Goswami, 2008: 389) Thus, we can see how social context and culture were crucial for Vygotsky to explain cognitive development. In a nutshell, while Piaget's theory focused on how knowledge is constructed by the child for his or her own self, Vygotsky gave significance to language and social interactions.

Language

Language can be found not only in speech, but also in other expressions, such as writing and sign codes. Having said that, Robert E. Owens (2008: 5), states that "although most languages can be transmitted by speech, speech is not an essential feature of language." Common examples of nonverbal language are sign languages and Mathematics; the latter considered as such for "its symbols have exact values and represent specific quantities and relationships" (Ibid).

When dealing with language, John M. Pearce (2008: 337) listed four points that he considered the most useful "for evaluating the linguistic skills of animals", thus presenting a first superficial association between human language as we know it and animal communication. The fist point described by Pearce is that of arbitrariness of units, which has to do with the fact that language is composed of discrete units, that is to say words, which are usually arbitrarily related to the events or things they refer to. In this first point, Pearce states that "in certain cases, such as alarm calls, animal communication is also composed of discrete units, but in others the signal consists of a coherent unified pattern, as with the dance of the honey- bee" (Ibid). The author also points out that, concerning the arbitrariness of the signal, there are some instances where this property is manifested and some others where it is not. The most common and clear example where this arbitrariness of signals is not present is in the posture of dogs displaying submission, aggression, and playing solicitation, as they are highly related to the emotional state they are signalling. For example, in an aggressive attack, dogs' ears are erect, titled forward; the tail is stiff, raised; and the hackle may be up. In contrast, when they are showing submission, their ears are back and their tail hangs low, slowly wagging.

The second point described by Pearce is that of semanticity. According to his words, "language allows the transfer of information from one person to another because each word has a specific meaning." As animals communicate by signals, he explains that "we shall presume that a signal, for an animal, has meaning if it can activate a representation of the event to which it relates". The third point corresponds to displacement, in which the author points out that "language allows people to communicate about events that are displaced either in time or in space". This feature of language is not present in any animal communication system, for animal signals are often performed as an "immediate reaction to an internal state, such as an increase in certain hormones, or an external event, such as the sight of a predator" (Ibid)

The last property taken by the author is productivity, which is related with the fact that language "is structured according to rules of grammar, or syntax. By using these rules an almost infinite number of sentences can be constructed, each of which will convey a different meaning" (Ibid). Contrary to common beliefs, this fourth property is also present in animal communication, even though it is scarcer and more limited than in human language. The author explains that the intensity of aggression could be considered as a demonstration of productivity, as well as "the way in which the honey- bee waggle dance is able to convey information about an almost unlimited number of spatial location" (Pearce, 2008: 338). However, the main difference between productivity in human language and animal communication is related with the fact that the latter lacks the sophisticated rule system that we do have. Thus, this fourth point described by Pearce is a key element when trying to compare both animal communication and human language. According to the author "natural communication by animals has never met the productivity criterion by combining discrete units, and this may be one characteristic that sets human language apart from the natural communication of any other animal" (Ibid). He also states that all the cases in which we can find productivity in animal communication, are "achieved by varying an attribute of the signal, such as its orientation or intensity" (Ibid).

Communication

Trevor Harley describes communication as "the transmission of a signal that conveys information, often such that the sender benefits from the recipient's response" (2001: 48). This signal is, therefore, the means that conveys informa-

tion such as smell or sound, in the case of animal communication. There are basically two types of signals: communicative signals which have an element of intentionality in them, and informative signals, which on the contrary, do not possess such intentional element. If we hear someone sneezing, we would probably think that that person has a cold; the sneeze would be our informative signal as we are being informed that person might be sick. For there to be a communicative act, that person must tell us that she or he has a cold; otherwise, it is not communication but purely information. In this respect, it has been demonstrated that animals are able to communicate with each other, which makes us realize that animal communication exists. Pearce states that "communication occurs when one organism transmits a signal that another organism is capable of responding to appropriately" (Pearce, 2008: 327).

BUT CAN ANIMMALS LEARN?

Many scholars consider that the main characteristic that defines animal intelligence is that of adaptability. This term refers to the ability that animals have to adapt to different circumstances, but it may be limited when comparing the intelligence of different species. Pearce (2008: 13) suggests that a possible solution for the problem mentioned is to accept that an animal that is able to benefit from its experiences, will adapt better than one that does not have this capacity of adaptation. That is to say, an animal that, for instance, is able to remember where food and predators are located, has a greater chance of surviving than an animal that cannot remember this. Having said that, "the animal that is faster at learning and better at remembering may be regarded as the more adaptable and hence the more intelligent" (Ibid).

Learning, at this point, can be said to occur once an experience results in a relatively ongoing change in the response to a situation. Pearce expands on this issue when he explains that for a given species, intelligence cannot be measured by the speed at which an animal develops a particular action, mainly because it will depend on the means used to measure it. For instance, a chimpanzee can quickly learn to press a button in order to get food, but he may have some problems when learning to perform the same response to avoid being pinched. Together with the speed of learning, there is also another problem to measure intelligence, posed by the inherent existing differences between species: when an animal is expected to learn a specific response for food, the speed at which it does so will be affected by several factors - contextual variables- such as the animal's own perception, motivation and motor processes. At this point, we might agree with Pearce's observation (2008:15) in relation to the scarcity of research in specific areas of animal learning such as the capacity of animals to remember what they have learned and the animals' ability to reason and to solve problems although these capacities should be considered as characteristics of intelligence as well.

It is important to mention as well that there have been several attempts to teach apes to speak; yet, they have all been unsuccessful due, in part, to the fact that the apes' vocal tracts are unable to produce all the speech sounds present in human language.

ANIMAL INFORMATION PROCESSING

One of the psychological techniques which investigate animals' information processing is the classical conditioning or Pavlovian conditioning which consists of the identification of those changes that occur in the nervous system during the learning of relatively simple tasks. For Pearce (2008: 20) this classical conditioning is "the use of a neutral stimulus to signal the imminent delivery of a biologically significant event. [And that] This training results in a change in the animal's reaction to the neutral stimulus." He goes on to say that there is evidence showing that this training could make it easier for one neuron to activate another in the animal's cerebellum. Another way of investigating information processing is the recognition of the variety of intellectual functions that take place in different regions of the brain. The experiments conducted in the area appeared to point in two directions: to damage the relevant regions of the brain or to monitor the activity within these regions. Apart from this, it is believed that different parts of the brain are important for storing different kinds of information. Aggleton and Brown (qted. in Pearce, 2008: 21) demonstrated that "as far as retrieving information from memory is concerned, recollecting a previous event has been shown to involve a different neural system to one concerned with recognizing an event as being familiar." Nonetheless, these findings have to face the fact that, given the complexity of the vertebrate brain, many problems of interpretation occur. Having said this, the specific role that a region of the animal brain plays in a specific task is still unknown. Pearce (2008: 21) adds that there is very little evidence about the changes that take place at a cellular level during any task with vertebrates, which would be crucial for understanding the physiological aspects of animal intelligence.

Summing up, psychological techniques seem to be helpful to clear up the mechanisms of vertebrate cognition; however, many years are likely to pass before there is a complete explanation and understanding of the connection between an animal's brain and his intelligence.

OUR MEMORY AND THEIR MEMORY

Goswami (2008: 251) defines memory as "the ability to retrieve autobiographical happenings from the past." She also states that "to travel back in time in our own minds may be unique to the human species" (Ibid). There are mainly four types of memory, and each one of them differs from the others depending on the nature and consciousness of the retrieval. As explained by the author, episodic memory is related to the retrieval of events and experiences taken from the past, while semantic memory refers to the individual's factual generic knowledge of the world, paramount of which is conceptual and linguistic knowledge. Episodic and semantic memories can be declarative, in which case they are explicit, i.e. the memories are recalled consciously and intentionally. Contrariwise, procedural memories, which are also found as part of memory, are unconscious and marked by changes in performance in which there is no participation of conscious memory content.

The study of animal memory is related to the understanding of how future behaviour can be influenced and modified by information already acquired at a specific time. In a manner similar to that of human memory, animals appear to present a distinction between two types of memory: short-term memory and long-term memory. In this respect, Pearce (2008: 191) refers to this distinction by postulating that short-term memory lasts for a relatively short period of time and is related with information about the immediate past; long-term memory, on the other hand, lasts for a much longer period of time and is related with the associations that are acquired during the course of classical conditioning.

Concerning short-term memory, although there are numerous studies revealing that animals do have this short-term retention, there is still little evidence showing the processes that are involved in the phenomenon. According to Pearce (2008: 199), animals may have short-term memory because information decays with time. There are two theories that explain short-term memory in animals: the decay theory and the limited capacity theory. The first one, in Pearce's words (2008: 202), explains that "forgetting occurs because, once an event has been presented to an animal, information about it gradually, and spontaneously, decays". The second one, on the contrary, explains that "animals are restricted in the amount of short-term information they are able to retain at the same time". Thus, this last theory appears to support the idea that forgetting occurs because old information is displaced by more recent information that has taken place in more recent events.

Long-term memory in humans is characterized by its large capacity and durability. Amazingly, these two characteristics can also be found in studies of long-term memory in animals. For instance, many studies with different types of birds reveal their large long-term memory capacity. They collect seeds throughout the whole autumn, and hide them in a considerable amount of shallow holes. Once winter comes, they are able to retrieve the hidden seeds to feed themselves and their offspring. With reference to durability, Pearce (2008: 215) describes a study in which a sea lion called Rio was originally trained to solve matching discriminations before she was taught a wide range of other tasks. After ten years, she was still able to remember how to match, and her performance presented only small differences which were not relevant. These are but two examples of the several studies that have demonstrated large capacity and durability in animals' long-term memory.

CONCLUSIONS

Many animals have complex communication systems that help them to survive. However, this communication is limited, at least, in topic and scope, and it usually depends on the context. The difference then, lies in the fact that these communication systems function in terms of the here and now, and not in the past and future events as it is the case of human language. However, there are a few items that both species share when communicating: the access to the vocal auditory channel, interchangeability, semanticity, tradition, and arbitrariness. There are other items that are only present in human language: complete feedback, specialization, openness, prevarication, reflectiveness, learnability, and displacement.

Human beings acquire and develop their communicative skills throughout their brain and mind development, and social interaction plays a crucial role in the acquisition of pragmatics. Even though social interaction is also essential in chimpanzees' learning processes, they do not have a pragmatic development. Thus, it may be possible to think that animals may have a semantic, lexical and even a grammatical development, but it is clear that they are not able to develop pragmatics as human beings do. This may reflect that, regardless the numerous efforts made, chimpanzees will never be able to communicate effectively, or at least as competently as humans do. This suggests the idea that only humans have social cognition, and that may be one of the main differences between animals and humans' cognition.

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